It is not clear, however, that the statement of 48 candles per cubic foot would not be equally misleading, as the light emitted from good acetylene burners varies enormously with the rate at which the gas is consumed, so that with small burners the illuminating value of the gas is rarely more than 20 candles a foot, whilst with 1-foot burners it is a remarkably good burner that gives 42 candles per cubic foot of gas consumed.

In referring to the formation of carbonaceous growths at the burner tips, the authors point out that although this has been put down to the action of heat on polymerisation products in the acetylene, yet that if this were the case the trouble should disappear entirely if the gas were washed with heavy oil before entering the burners, this procedure, however, not giving entire freedom from the trouble. In this criticism, however, they evidently overlook the fact that not only does polymerisation of the acetylene take place where there has been undue heating in the generator, but that no matter how thoroughly the gas may be purified before reaching the burner, a further, though small, polymerisation will take place in its flow through the heated steatite tips at which it is burning, and that the trace of benzene so formed is quite capable of giving the trouble.

The practical details given as to size of pipes and other points upon which little or no knowledge exists amongst generator makers are of the greatest value, and the book may be most heartily recommended to all interested in the production and use of acetylene.

THE TSETSE FLIES.

A Monograph of the Tsetse Flies (Genus Glossina, Westwood). Based on the Collection in the British Museum. By E. E. Austen, with a Chapter on Mouth-Parts by H. J. Hansen, Phil. Doc. Pp. ix+319. (London: Printed by Order of the Trustees, 1903.) Price 15*s*.

SOME fifty years ago J. O. Westwood gave a description of a "destructive species of dipterous insect known under the name of Tsetse," and referred it to the genus Glossina, first established twenty years previously by Wiedemann. From that time onwards references to the tsetse fly and its association with a mysterious disease fatal to horses, cattle, and other animals become very numerous in the writings of travellers and naturalists, and various were the theories propounded to explain the relation of the fly to the disease. Drysdale, in 1879, seems to have been the first to suggest that the tsetse fly disease might be of an infective nature, the infecting agent being conveyed by the bite of the fly. In 1895 and 1897 the well-known reports of Lieut.-Colonel Bruce appeared. He described the tsetse fly disease or nagana met with in Zululand, and established the fact that it is due to a protozoan blood parasite, the *Trypanosoma Brucei,* which is conveyed by the bites of the tsetse fly from affected to healthy animals. As horses and cattle are unable to exist in the districts inhabited by the fly, the problem of transport in these "fly belts" is a serious one, and the tsetse fly and its distribution have assumed great economic importance. In India and Burma there is a similar, if not identical, disease known as surra, which is also conveyed by a biting fly perhaps a species of Stomoxys.

Within the last few months evidence has been accumulating, through the work of Castellani, Bruce and others, that sleeping sickness, the ravages of which have assumed alarming proportions, may be caused by a trypanosome (*T. Castellanii*) attacking the central nervous system (see NATURE, vol. lxviii. p. 116).

From analogy with nagana and other facts (see NATURE, vol. lxix. p. 34) it would seem probable that a tsetse fly conveys the infection in this disease, and therefore that measures of prevention and extermination directed against the fly might stamp out sleeping sickness. Other diseases also, *e.g.* trypanosoma fever, are caused by species of trypanosomes, and these, too, may very likely be conveyed by tsetse flies.[1]

In view, therefore, of the practical importance of an accurate knowledge of the genus Glossina, the Trustees of the British Museum have been well advised to publish this monograph upon the tsetse flies, the preparation of which has been entrusted to Mr. Austen. We may say at once that Mr. Austen has produced a work which must for some time remain the standard one upon the subject. He gives both a popular and a scientific description of the flies, a full bibliography with copious abstracts, the whole being illustrated with many figures in the text, with a map showing the geographical distribution, with beautiful coloured plates of the seven known species from drawings by Signor Terzi, and with two plates of the mouth-parts of Glossina and Stomoxys. The latter, together with a description, are by Dr. Hansen, and will enhance the value of the volume to the dipterologist.

In the first place it is to be noted that, although the term "the tsetse *fly*" is usually employed, there are at least seven species, so that "tsetse" becomes a *generic* rather than a specific name. By some the original *Glossina morsitans* has been called the "true tsetse." The name "tsetse" is of obscure origin, but is certainly onomatopoetic, derived from the peculiar buzzing sound made by the fly on the wing. The tsetses are confined to Africa, are always met with in the neighbourhood of water, and are often restricted to peculiarly well-defined tracts of country. Mr. Austen's description of them may be reproduced here, since NATURE may reach many who may not have access to this monograph:—

"The tsetses are ordinary-looking sombre brownish or greyish-brown flies varying in length (excluding the proboscis) from $3\frac{1}{2}$ to $4\frac{2}{3}$ lines ($7\frac{1}{2}$–10 mm.) in the case of *Glossina morsitans* to about $5\frac{1}{2}$ lines ($11\frac{1}{2}$ mm.) in the case of *Gl. fusca* or *longipennis,* with a prominent proboscis in all species. The hinder half of the body, or abdomen, in the best known species, though not in all, is of a paler colour and marked with sharply defined dark brown bands, which are interrupted on the middle line; the abdomen, however, is invisible when the insect is at rest, as it is then concealed by

[1] Since the above was written, a further report on sleeping sickness by Col. Bruce has been issued. In this much additional evidence is given of the correctness of these views of the nature of sleeping sickness and of its transference by a tsotse. Trypanosoma fever may be the early stage of sleeping sickness.

the wings. . . . In *the resting position* their identification is easy. In this attitude they can be distinguished from all other blood-sucking Diptera . . . by the fact that the brownish *wings lie closed flat over one another down the back,* like the blades of a pair of scissors, while *the proboscis projects horizontally in front of the head*" (p. 3)

There is one peculiarity of *Gl. morsitans* that may be noted, viz. it does not lay eggs as do the majority of the Diptera, but extrudes a yellow-coloured larva nearly as large as the abdomen of the mother. Whether this process is the same in all species has yet to be determined. Of the seven species of tsetse described, one (*Gl. pallidipes*) is new, and appears to be the East African representative of *Gl. longipalpis*. The work concludes with some valuable appendices of information from travellers, Government reports, the reports of Colonel Bruce and others.

When the transmission of malaria by the mosquito was proved, the authorities of the British Museum rose to the occasion and published the magnificent monograph upon the Culicidæ by Mr. Theobald; again they have not disappointed us. In conclusion we would direct attention to the series of models in the entrance hall of the Natural History Museum of the trypanosome and tsetse fly, and of the malaria parasite and mosquito; they should be studied by all who may have the opportunity of increasing our knowledge of these and other tropical diseases.

R. T. H.

METALLURGY OF STEEL.

Hardening, Tempering, Annealing, and Forging of Steel. By Joseph V. Woodworth. Pp. 288. (Westminster: Constable and Co., Ltd.) Price 10*s.* net.

TO students who have ploughed through the weary sands of recent steel literature, Mr. Woodworth's book will appear somewhat in the nature of an oasis in the desert. The author does not appear to be versed in the "ites" of metallography, or fully to have grasped the allotropic theory of hardening, but, nevertheless, he does thoroughly understand tool-steel. Authors of papers on the restoration by heat treatment of faulty steel will hardly be prepared to acquiesce in a statement made by Mr. Woodworth on p. 18 of his book, namely,

"Heating for forging is, in its way, quite as important as heating for hardening; care and uniformity in the application of heat in the first instance is very essential. Should the steel be over-heated in this process, no amount of care afterwards will restore the steel to its former state or remedy the evil."

With the words above quoted everyone who has had an extensive practical experience of steel metallurgy will be more than inclined to agree.

On p. 24 attention is directed to the fact that steel as delivered from the manufacturer is always more or less decarbonised on the surface.

"For this reason, do not select a piece of steel which will just 'skin' up, but take a piece large enough to require taking a good-sized cut before reaching the finished surface."

This is good advice, not only to mechanics, but also to scientific men making researches on the magnetic properties of steel. Mr. Woodworth, in concise and lucid terms, deals at considerable length with the machining, hardening, and tempering of nearly every class of steel tools, and the value of his letter-press is enhanced by a series of admirable illustrations (chiefly in perspective) of turning tools, taps, reamers, and an excellent set of milling cutters.

A brief illustrated article on muffle furnaces (pp. 92–94) is well worth the attention of British artisans, as showing American practice, which is, on an average, undoubtedly superior to that obtaining in this country.

That portion of Mr. Woodworth's book dealing with the manufacture of dies and of drop forgings must necessarily be interesting to British manufacturers and workmen, because America was the birthplace of drop forgings, which were first manufactured by Colonel Colt, of revolver fame, in 1853.

Another feature of the work now under review is the fairly complete and beautifully illustrated chapter on the emery-grinding of steel tools. Mr. Woodworth advocates as the highest type of forgings material which has been quenched in oil and subsequently tempered to remove contraction stresses. The views he expresses have already found favour with many experienced British steel metallurgists.

On p. 162 Mr. Woodworth leaves, for the time being, a branch of steel metallurgy in which he is evidently a past master, and becomes controversial on the well-worn argument of steel *v.* wrought iron forgings. In deciding upon the superiority of steel, the author perhaps a little overdoes it, and his quotation from the report of the American Government tests on alternating stresses will hardly convince steel metallurgists who have closely studied this matter.

The tests he quotes show that wrought iron is capable of enduring only 50,000 alternations. Steel, with 0·25 per cent. of carbon, endures, before fracture, 229,000 alternations, whilst steel with 0·45 per cent. of carbon sustains almost a million alternations. The author considers that these figures

"have given engineers an idea of the comparative endurance of wrought iron and steel in such service as that to which crank-pins, shafting, &c., are subject."

Had Mr. Woodworth seen a verbatim report of the trial to decide the cause of the disaster on H.M.S. *Bullfinch,* which occupied several days at the King's Bench in the summer of 1902, he would probably have expressed a much modified opinion on the question at issue. Broadly speaking, the connecting rods of the *Bullfinch* were of the higher carbon limit just quoted; the rods of H.M.S. *Snapper* contained about the lower limit mentioned, namely, 0·25 per cent. of carbon. The rods of the *Bullfinch* snapped on her trial trip, causing lamentable loss of life. Those of the *Snapper* were taken out intact after the destroyer had run her trial trips and been four years in commission.

An interesting portion of this book is the description of the Taylor-White process, which was the pioneer of those steels known as "speedy-cut," but quite naturally Mr. Woodworth does not specially direct